

In the claims:

Please amend the claims as follows.

- 1        1. (Amended) Method for characterizing a ballistic item including the steps:
  - 2                a. Produce a sequence of digitized passive infrared images of the item
  - 3                at different focus points such that the deepest to the highest features are each
  - 4                in sharp focus in at least one image,
  - 5                b. tag each image with the ID of the item,
  - 6                c. tag each image with specifics of the imaging set-up including the
  - 7                focus position, and size of digitized image array
  - 8                d. store the tagged image sequence in a database
  
- 1        2. Method of claim 1 with the additional step:
  - 2                e. produce a photomontage from the tagged image sequence in which
  - 3                each section of the montage image is the corresponding section of the image
  - 4                from the tagged sequence in which that section is in sharpest focus
  
- 1        3. (Amended) Method of claim 1 or 2 with the additional step of replacing [
  - 2                f. replace] each tagged image in the sequence with a tagged extracted
  - 3                feature image containing only features at least a specified size extracted from
  - 4                the tagged image
  
- 1        4. (Amended) Method of claims 1, 2, or 3, further comprising [with the
  - 2                additional] steps:  - 3                [g. add] adding to each tag weapon-specific ancillary information
  - 4                including calibre, type of ammunition, direction of twist, number of lands,
  - 5                serial number, and

6 [h. add] adding to each tag incident-specific information including  
7 type of crime committed, location where item was found, associated names,  
8 method of crime.

1 5. (Amended) Method for identification of a ballistic item including the  
2 steps:

3 a. characterize the unknown ballistic item by producing a tagged  
4 image sequence

5 b. compare the image sequence with those contained in a database

6 c. determine those sequences in which one or more images are similar  
7 to the unknown tagged image sequence

8 d. display the similar [pairs] pair(s) of images to a ballistics examiner  
9 who reviews the display and rules that the unknown ballistic item is a match to  
10 an item in the database if the similar pair(s) of images are sufficiently alike.

1 6. (Amended) Method of Claim 5[. In which], wherein step [f] d is  
2 performed automatically by further image processing

1 7. (Amended) Method of Claims 5 or 6 [ including also the step:], further  
2 comprising the steps:

3 [e. compare] comparing the weapon-specific and incident-specific  
4 tagging information of the similar image [pairs] pair(s):

5 [a. Display] displaying the similarities and dissimilarities in the  
6 tagging information along with the images for further consideration[.] by a  
7 ballistics examiner who reviews the display and rules that the unknown  
8 ballistic item is a match to an item in the database if the tagging information  
9 as well as the similar pair(s) of images are sufficiently alike.

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1 8. (Amended) Method of Claim 7 [in which step I], wherein the reviewing by  
2 the ballistics examiner is performed automatically by further image  
3 processing.

1 9. (Amended) Method for identification of a ballistic item including the  
2 steps:

3 a. characterize the unknown ballistic item by producing from passive  
4 infrared images a tagged extracted feature sequence

5 b. compare the extracted feature sequence with those contained in a  
6 database

7 c. determine those sequences in which one or more extracted features  
8 are similar to the unknown extracted feature sequence

9 d. display the similar pairs of extracted features to a ballistics  
10 examiner who reviews the display and rules that the unknown ballistic item is  
11 a match to an item in the database if the similar pair(s) of extracted features  
12 are sufficiently alike.

1 10. (Amended) Method of Claim 9[. In which], wherein the reviewing by the  
2 ballistics examiner [step d] is performed automatically by further image  
3 processing

1 11. (Amended) Method of Claims 9 or 10 [including also], further  
2 comprising the steps:

3 [e. compare] comparing the weapon-specific and incident-specific  
4 tagging information of the similar extracted feature [pairs] pair(s); and

5           [f. Display] comparing the similarities and dissimilarities in the  
6           tagging information along with the extracted features for further consideration  
7           by a ballistics examiner who reviews the display and rules that the unknown  
8           ballistic item is a match to an item in the database if the tagging information  
9           as well as the similar pair(s) of extracted features are sufficiently alike.

1           12. (Amended) Method of Claim 11, wherein said comparing step [in which  
2           step f. Is] is performed automatically by further image processing.

1           13. (Amended) Method of Claim 1 [including also], further comprising the  
2           steps:

3                   [e. ] heating or cooling the ballistic item to vary its temperature;  
4                   [f. ] producing an image sequence in which both focus and temperature  
5           are varied; and  
6                   [g. ] tagging each image with the corresponding temperature.

1           14. (Amended) Method to identify illumination-induced artifacts in visible  
2           light photography of ballistic items including the steps:

3                   a. Produce visible and IR image sequences of the same ballistic item;  
4                   b. extract features from each image in each sequence;  
5                   c. tag as a candidate illumination-induced artifact each feature in a  
6           visible image which does not have a corresponding IR feature; and  
7                   d. tag dark visible artifacts as possible shadows and light artifacts as  
8           possible glint.

1           17. (Amended) Method to differentiate manufacturing marks and  
2           weapons-related tool marks on shell casings including the steps:

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3 a. adjust the focus on the IR camera such that the manufacturing  
4 marks are in focus;

5 b. adjust the temperature of the ballistic item such that the  
6 manufacturing marks are most distinct from the surrounding area; and

7 [b]c. threshold the resulting image to create a template of the  
8 manufacturing marks to be used for matching or for eliminating the marks  
9 from that image prior to further matching.

1 18. (Amended) Method to detect residue on a ballistic item, including the  
2 steps:

3 a. apply a sequence of spectral filters to the IR camera

4 b. for each filter, vary the focus to produce an image sequence of  
5 passive infrared images

6 c. extract features from each image in the sequence

7 d. compare the feature sets in images which have the same focus  
8 setting but different spectral filters

9 e. display those features which are filter-sensitive as possible residue

10 f. Annotate features with likely type of residue based upon the filter  
11 sensitivity.

1 19. (Amended) Apparatus for characterizing a ballistic item including:

2 a. IR camera with lenses and focus control

3 b. Mechanism for varying the focus control to produce a sequence of  
4 images

5 c. Image digitizer and storage

6 [c]d. Mechanism for tagging images with [ancillary] ancillary  
7 information

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8 [d]e. Feature extractor  
9 [e]f. Processor for characterizing the features  
10 [f]g. Processor for creating a montage  
11 [g]h. Display  
12 [h]i. Mechanism for positioning the item within the camera field of  
13 view\_

1 20. (Amended) The apparatus of claim 19 including also the elements:  
2 [i.]j. device for heating the ballistic item  
3 [j.]k device for measuring the temperature of the ballistic device  
4 [k.]l. device for applying optical filters before the camera lens  
5 [l.]m. mechanism for tagging the resulting images with temperature  
6 and filter data\_

1 21. (Amended) Apparatus for identifying a ballistic item including the  
2 elements of 20 plus:  
3 [m.]n. Database of characterized ballistic items  
4 [n.]o. Database matching engine  
5 [o.]p. Output or display mechanism

1 22. (Amended) Method for identifying a ballistic item including the steps  
2 a. for each montaged infrared image [in the] derived from an unknown  
3 item database and [the] a known item database produce a relative location map  
4 as follows:  
5 b. compute the centroid location for each feature, including all  
6 striations, gouges, breech face marks, and firing pin indents, where each  
7 striation is considered a separate feature.

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- 8 c. Compute the distances between each pair of centroids  
9 d. Tag the distances with the type of feature represented at each end  
10 e. Match the list of tagged distances with corresponding lists for the  
11 known item database.

- 1 23. (Amended) Method for separating manufacturers marks from weapons  
2 marks in ballistic images, including the steps:  
3 a. heating the ballistic item to [temperature which enhances] enhance  
4 the manufacturers marks;  
5 b. producing [an] a passive infrared image of the ballistic item;  
6 c. producing a template of the areas containing the enhanced  
7 manufacturers marks; and  
8 d. extracting the template areas to form an image containing the  
9 manufacturers marks;  
10 [e.] wherein the remaining image [containng] contains no  
11 manufacturers marks but [containing] contains weapons marks which did not  
12 overlay manufacturers marks.

- 1 24. (Amended) Method for estimating the volume of groves, indentations and  
2 striations in ballistic items including the steps:  
3 a. heat the ballistic item to an elevated temperature  
4 b. measure the mean temperature of the item using [the] a radiometric  
5 infrared camera  
6 c. capture a sequence of passive infrared images as the item cools  
7 d. capture for each image the mean temperature using the radiometric  
8 camera

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